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VEGETATION MANAGEMENT PLAN

FOR

WILLIAM HEISE PARK

FOR

THE COUNTY OF SAN DIEGO

JULY 28, 2005

WILLIAM HEISE PARK

VEGETATION MANAGEMENT PLAN

June 12, 2006

Approved by:

Renée E. Bahl

Renée E. Bahl, Director
County of San Diego
Department of Parks and Recreation

12 June 2006

Date

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Appendices

Executive Summary

Following the significant impacts of the Cedar fire at William Heise Regional Park, planned and deliberate treatments to the remaining vegetation are required to enhance and restore the parks ecological and recreational value. A quality experience at the park has always relied on the beauty of its forest and brush covered landscapes.

Restoration of the cherished habitat at the park will require implementation of a vegetation management program. Appropriate vegetation management treatments used in conjunction with multi-species conservation programs, and potential fire management efforts should result in a vegetative arrangement that minimizes future wildfires ability to impact to the park and its visitors. Perpetual management efforts to create a park setting with limited fuel hazards and effective noxious weed control should be ongoing. The fuel reduction imposed by the Cedar fire should be viewed as an opportunity to optimize the parks overall condition.

The thirty year vegetation management plan developed for the park will appeal to the parks overall goal to provide a quality recreation environment in a beautiful wildland setting, and will continue to mitigate the potentially negative impacts of flammable forest vegetation. This plan will recognize findings and follow the recommendations outlined in the Final BAER Report[1] created for the Cedar fire, the Mitigation Strategies for Reducing Wildland Fire Risks[2], the county's Draft Preliminary Fire Protection Plan for William Heise Regional Park[3] and the California Vegetation Management Program[4]. The proposed 30 year vegetation management plan will utilize Integrated Vegetation Management (IVM) techniques that will help park managers gain and maintain compliance with Federal environmental law (NEPA), State environmental law (CEQA), and adopted local codes. In doing so, the park will also encourage a safer, healthier more diverse vegetative cover with lower risk of devastating high intensity wildfire.

[1] San Diego County Biological Resource Researchers. 2003. A Summary of Affected Flora and Fauna in the San Diego County Fires of 2003. 36pp.
[2] San Diego County Wildland Fire Task Force Findings and Recommendations, Report to Board of Supervisors. 2003. Mitigation Strategies for Reducing Wildland Fire Risks. 32pp.
[3] Miller, K.J., and Steinhoff, R. 2004. County of San Diego, Draft Preliminary Fire Protection Plan. 22pp.
[4] California Department of Forestry and Fire Protection. 2000. Final Program Environmental Impact Report for Vegetation Management Program. Jones and Stokes Associates, Inc. Sacramento, Ca.

Background Information

Location

William Heise Park is located in a canyon along Cedar Creek about 5 miles south of Julian, California. The park is approximately 900 acres covered with varying terrain and vegetation and bordered by private property on the north and southeast and Cuyamaca State Park to the south.

Management History

Established in 1969, Heise Park has witnessed variable management strategies in the past 35 years. During the 1970's it became well accepted that fire suppression and exclusion may have adverse effects on native vegetation within the park. Harold Biswell a known proponent of prescribed burning as a technique for vegetation management[5], developed a plan in 1980[6]. For a short period from 1978 to 1981 increased vegetation management, including the use of prescribed fire, was utilized within the park.

Currently, the park offers year-round camping, including 4 simple cabins for overnight use, as well as lush day-use areas. During the Cedar fire of 2003, approximately 70% of Heise Park was burned. While a majority of this area, particularly the south and east, was severely burned, a cooler, less severe fire burned the northeast area nearest the tent campgrounds. In the northeast border zone, partially burned young pines and dense undergrowth still exist. The severely burned areas are currently ashen with grasses and small shrubs attempting to reclaim the land. Many burned trees still stand in these areas.

Land and Environment

Vegetation

Within Heise Park are eight vegetation types according to a 1995 survey of the region. This survey utilized the Holland vegetation classification system. However, the evolution of vegetation in the Park has created additional sub-zones within each Holland class. These zones reflect unique management considerations. This temporal information representing vegetative cover will remain valuable as post-fire recovery is monitored. Used in conjunction with today's satellite imagery tracking changes and managing vegetation for a desired condition is more possible than ever before. The 1995 survey illustrates the parks vegetative condition prior to the 2003 Cedar fire. The satellite information obtained in 2004 by Davey Resource Group illustrates the current vegetative condition with additional infrared and fuels analysis. Both data sets were analyzed using GIS for the development and future monitoring recommendations outlined in this plan.

[5] Biswell H.H. 1989. Prescribed Burning in California Wildlands Vegetation Management. University of California Press. Berkeley, Ca. 255pp.
[6] San Diego County Office of Fire Services 1980. Prescribed Fire Management Plan for Heise County Park. 13pp.

I. Sierran Mixed Conifer Forest

This zone extends across the southern half of the Park from the campsites along the south bank of the creek to the far west boundary. Although this vegetation class is a subcategory of Lower Montane Coniferous Forest, the zone in Heise Park contains a rather small percentage of conifer species (pre- and post-fire event). Plots 2, 4, 5, 12, and 13 were placed across the zone in an effort to confirm vegetation classes (see section 4, "Analysis"). Although a mixed conifer zone does exist, this zone is more appropriately divided into 3 sub-zones based on species composition and differing management concerns.

A. True Mixed Conifer

This zone is found in close proximity to Cedar creek on the south bank. Incense cedar and occasionally Coulter pine dominate this vegetation zone. Mature coast and canyon live oaks are sprinkled throughout. Regeneration is limited to mostly oak basal sprouts from fire-damaged trees. Large openings in the canopy provide opportunity for Jeffrey Pine (Pinus jeffrey), Coulter Pine (Pinus coulteri), and California Incense Cedar (Calocedrus decurrens) to aggressively regenerate by seed. Plot 13 is a sample of this vegetation sub-zone.

Current photos of sample plot 13, used to verify satellite imagery analysis.

Management considerations:

1. Current understory density is not optimal for forest health or fire management. This condition can be managed using IVM practices. (see section 3, "Management Recommendations, Kelly Ditch Treatment Area").
2. Fuel shading is high and groundcover minimal. A dense canopy will prevent regeneration of shade intolerant species. Long-term impacts from the fire on remaining incense cedars will initially be a challenge to determine. As the mature cedars die, oaks can replace the existing canopy. If incense cedar is to remain a dominant species in this sub-zone, conifer regeneration must be managed.

B. Mixed Live Oak/Conifer

This sub-zone is more similar to most of the central & north central areas of the Park than a mixed conifer zone. Coast live oak and canyon live are the dominant species and very few pines and cedars are found. Data is recorded in Plots 2 and 4.

Overview of sample plot 4 vegetative cover

Photo of sample plot 12

Management considerations:

1. The vegetation at the border of this and the True Conifer sub-zone (data in Plot 12) could switch to either sub-zone depending on management. Currently it resembles the oak dominant forest to the south, though large holes in the canopy have allowed some incense cedar regeneration.
2. Sheet erosion is heavy down the hillsides. Existing silt dams are not providing adequate protection.

C. Mixed Black Oak

This vegetation type is seen only in two areas of the Park and virtually absent in all other areas. The finger at the Park's northeastern border is in a ravine where California Black Oaks have populated the riparian corridor (Plot 23). Of greater note is the large sub-zone of black oak dominated forest at the southwest corner of the Park. Data is recorded for this sub-zone in Plot 5. Regeneration is greater in this area, as the fire seems to have left many mature trees. Management recommendations are referenced in the Sierran treatment area.

Sample Plot 23

Management considerations:

1. Black oak regenerates by basal sprouts. Competition with surrounding grasses and shrubs can be a limiting factor. The current canopy is disturbed with large openings where shrub species can flourish.

II. Mixed Oak/Conifer Forest

The central area of Heise Park, as well as the Urban/Developed areas, is categorized as mixed oak forest. Coast live oak is most abundant, with pockets of canyon live oak, limited Coulter pine and Big Cone Douglas fir. When separated into sub-zones, distinct vegetation differences present themselves.

A. Mixed Oak Forest

Vegetation in this sub-zone is homogenous: coast live oak, with some canyon and minor percentages of other species. While the central segment of this sub-zone escaped fire, the southeastern segment is heavily burned. Data for this sub-zone is recorded in Plots 6, 10, 11 and 24. Management recommendations are referenced in the Cedar treatment area.

Sample Plot 11

Sample Plot 24

Management considerations:

1. In the heavily burned areas, sheet and gully erosion is rampant, especially where there has been mechanized disturbance.
2. In the burned portions of this community, there remains a large quantity of standing dead trees that may eventually fail. Patrol for hazardous conditions will be required
3. Thinning and fuel reduction should be considered high priority treatments.

B. Canyon Live Oak Forest

This sub-zone is located in the NW corner of the Park, on the Canyon Oak Trail. Coast oak yields dominance to canyon live oak, with small occurrences of chaparral. Data is recorded in Plots 16 and 17. Although this is a small sub-zone, the vegetation differs markedly. Management recommendations are referenced in the Trails treatment area.

Sample Plot 16

Sample Plot 17

Management considerations:

1. Oak regrowth in these areas is limited to basal sprouts from existing trees. In some areas, shrub species are also resprouting quickly.

C. Mixed Canyon Live Oak

Markedly different than the Canyon Live Oak Forest sub-zone, this sub-zone resembles the chaparral zone it borders. The canyon live oaks are small and interspersed with chaparral and scrub species. Data is recorded in Plots 14, 15, 19, and 21. Recommended management is discussed in the Trails treatment area section.

Sample Plot 14

Sample Plot 15

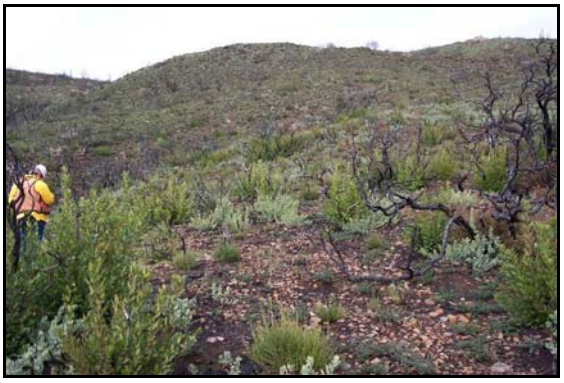
III. White Alder Riparian Forest

This zone is comprised almost completely of white alder, with a few mature coast live oaks. The zone follows the Cedar Creek tightly, extending not more than 50 feet on each side. Data for this sub-zone is recorded in Plot 3. As an adventitious sprouter, current regeneration of Alder is strong.

IV. Chaparral

This zone compromises the northeastern corner of the Park. This area was heavily burned, and regeneration and groundcover are dominated by chaparral and scrub species, with almost no tree species present. Around the boundary, more canyon oak and scrub species are interspersed with the chaparral. Data is recorded in Plots 18 and 22. Management recommendations are referenced in the Trails treatment area section.

Sample Plot 18



Sample Plot 22

Management considerations:

1. Ground coverage in these areas is almost exclusively manzanita and other chaparral species. Most of the trees in this area were destroyed in the Cedar fire. Chaparral species will densely repopulate this zone.

V. Mixed Chaparral

The eastern border of the Park (south of the entrance) is classified as Mixed Chaparral. This zone had a light but consistent Coulter pine mix before the fire. Current conditions are recorded in Plots 7, 8, and 9. The zone is striated with ravines that augment the vegetation list with canyon live oak (reflected in the data for Plot 8 on the interface).

Sample Plot 9

Management considerations:

1. Regeneration is 75% or greater manzanita or chaparral species. Seedling regeneration from desired tree species should be managed for protection

VI. Grassland

North of Cedar Creek, two open grassland areas exist. Ground coverage and grass/shrub regeneration is high, while tree species are few to none. In the larger of the two areas to the west, logging slash, equipment and chips have adjusted the terrain. Data is recorded in Plot 26. Management is recommended in the Cedar treatment area section.

Sample Plot 26

Management considerations:

1. Pockets of shrub vegetation and grass are dense and seasonally become notable fuels.

VII. Urban/Developed

This classification indicates that the vegetation type has been interspersed with pavement and structures. For Heise Park, the Urban/Developed class reflects the Mixed Oak Forest sub-zone of the Mixed Oak/Conifer class. Plots 1, 20, and 25 reflect various situations within this zone. Recommended management is discussed in the Cedar treatment area section.

Sample Plot 20

Management considerations:

1. Understory vegetation and fuels remain dense.

Soils

According to survey data, seven distinct soil series are found in Heise Park. These distinctions are primarily due to differences in slope. These seven series are composed of two primary soil types, the Sheephead and Boomer soils[7]. Sheephead Rocky fine sandy loam (2 classifications differentiated by slope) is found on the northeastern slope. Two classes of Boomer loam are found on the less steep slopes around the developed areas and above the Park to the west. Boomer stony loam (2 classifications differentiated by slope) composes the southern area of the park. The terrain in the park varies as much as 1100 feet. Slope and soil type should be considered when deciding which IVM treatments are best for each treatment area.

Rainfall

William Heise Regional Park is situated on the northern end of the Cuyamaca Mountain Range. This mountain range can produce annual rainfall totals averaging over 35 inches. This higher than average amount of precipitation allowed for the development of a vegetative community similar to those found on the Sierra and Sequoia National Forests. This region is also prone to seasonal drought. While trees don't typically feel short-term stress associated with summer drought. Long-term drought can debilitate and weaken a tree to the point that other factors (insects, fire, etc.) can cause mortality. Prolonged drought followed by beetle infestation combined to create a hazardous fuel condition in the park before the 2003 firestorms.

[7] San Diego County Soil Survey

Wildlife

Wildlife and wildlife habitat should be taken into account when implementing the IVM in William Heise Park. The IVM treatments should be utilized to maximize biodiversity within the park, regardless of the treatment area involved. Managers should review the current list of threatened and endangered species known to be in or near the parks boundaries[8]. Treatments to the vegetation can dramatically affect the way wildlife uses the park.

While San Diego County is host to a high number of protected wildlife species, few species of concern reside in William Heise Park. A consorted effort will still be required to maintain and improve the potential habitat. The IVM treatments completed within the park should take into consideration any potential impacts to wildlife. Important wildlife elements include populations of invertebrates, birds, reptiles, amphibians, fish, and mammals. The following is a preliminary itemization of potential vegetation management implications to regional wildlife found in or near William Heise Regional Park

Invertebrates

Hermes copper is an endemic butterfly that relies on the host plant spiny redberry (Rhamnus crocea) to complete its lifecycle.

Laguna Mountain Skipper is one of the most rare butterflies in North America, according to the Final BAER report for the San Diego County Fires of 2003. This butterfly has a lifecycle association with the host plant Cleveland Horkelia (Horkelia clevelandii).

Birds

Critical habitat for migratory birds is often associated with vegetative cover. Of particular concern for William Heise Regional Park should be identification of nesting sites for California Spotted Owl, Bald Eagle, and Golden Eagle. Whether for nesting or forage native vegetation is critical for the lifecycle of birds. Care must be taken to avoid disturbing nesting sites during IVM treatments.

Reptiles and Amphibians

Care and consideration to reptile and amphibian habitat should also be incorporated into the selected IVM treatments. This wildlife group populates a wide range of vegetative habitats within the park. Species of special concern to park managers need to be identified so timing of treatments minimizes potential impacts.

[8] A Summary of Affected Flora and Fauna in the San Diego County Fires of 2003, San Diego County Biological Resource Researchers, November 14, 2003.

Fish

Cedar Creek is host to native strains of rainbow trout (Oncorhynchus mykiss). IVM treatments should be minimal in riparian areas. An understanding of vegetations buffering effects on stream dynamics is important to understand when selecting IVM treatments.

Mammals

Vegetation management can drastically impact the way mammals utilize the landscape. Care should be taken to select IVM techniques that create habitat and corridors for desired species of mammals within the park.

Fire Management

Native vegetation in the park is adapted to fire. Most plant species rely upon its influence to maintain the vegetative communities composition and structure. The horizontal and vertical arrangement of vegetation effects fires behavior of most significance its intensity and duration on any given site. Future vegetation management should include utilization of fire to manage a condition less prone to stand replacing wildfire conditions.

IVM techniques should be appropriately chosen to reach a desired effect in each management area of the park. IVM treatments can mimic the effects of wildfire, as well as reduce fuel loading, but may not possess all the same benefits or cost savings possible when fire as a management tool is better utilized.

The 1980 plan developed by Harold Biswell should be utilized as a proven model for current management decisions. Recommendations within the Biswell plan should be considered valid and appealed to when utilizing fire within the park to manage vegetation. This plan outlines the significant factors and conditions to consider when using fire.

In addition to the Biswell plan, recognition and implementation of the recommendations outlined in the April 2004, Draft Preliminary Fire Protection Plan should be addressed.

Fire management in William Heise Regional Park is under jurisdiction of the California Department of Forestry and Fire Protection (CDF). Before fire is considered, CDF should be consulted.

Utilities

San Diego Gas and Electric Company services utilities to the offices and homes in and around William Heise Park. As a result of this service, maintenance is required to maintain compliance with state public resource codes 4293 and 4292. Annually, the utility inspects vegetation clearance with high voltage power lines and prescribes work, as maintenance is required. Park management should cooperate with the utility to minimize the need for future management actions near high voltage power facilities. Whenever possible trees under or next to power lines should be removed, and understory should be thinned. As corridors around the high voltage wires are opened up, the park should incorporate management of these zones into their routine

maintenance work. This will increase service reliability, reduce unnecessary traffic in the park, and promote a safer environment. Remember that these areas require unique attention.

Legislation

When considering land management in a government park, it is vital to review all relevant laws pertaining to the flora and fauna contained within.

Federal

California law often meets or exceeds Federal law in regard to vegetation management. However, recognizing the mandates set forth in the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Clean Air Act and the Migratory Bird Act is still necessary.

State

California has many laws that apply to management activities in state and county parks. The California Environmental Quality Act requires public agencies to submit EIR, EIS for projects of potential significant environmental impact. The California Endangered Species Act (Dept. Fish & Game) restricts activities that may negatively affect endangered species, directly or indirectly (i.e. habitat). The Porter-Cologne Water Quality Act establishes Regional Water Quality Control Boards throughout California to govern possible effect on State waters. Managers should check with the Regional Board before embarking on a large-scale vegetation management project that may impact the park's streams and possibly State waters.

With regard to implementation of the Vegetation Management Plan in Heise park, two state produced documents outline all potential environmental impacts and provides appropriate best management practices, the September 1998, Draft Program Environmental Impact Report for Vegetation Management Program[9] and the subsequent April 2000, Final Program Environmental Impact Report for Vegetation Management Program[10]. The 1998 draft is a detailed document that outlines all potential environmental impacts associated with an integrated vegetation management program. It is an excellent document to reference when Best Management Practices are outlined for the park. The 2000 Final draft represents the same document, but includes input from the public. This input dominantly focuses on the use of herbicides. This final draft compels the state VMP to avoid large-scale use of herbicides. However, since San Diego county has successfully utilized herbicides within its jurisdiction, is recommended herbicides be used in managing portions of the vegetation in Heise Park. This serves as explanation for referencing both documents.

[9] Program Environmental Impact Report for Vegetation Management Program, California Department of Forestry and Fire Protection. Jones and Stokes Associates, Inc. September 1998.
[10] Final Program Environmental Impact Report for Vegetation Management Program, California Department of Forestry and Fire Protection. Jones and Stokes Associates, Inc. April 2000.

Municipal Codes

- 55.0101-Adoption of California Fire Code
- 55.9201-Special Hazards Appendix II, A Suppression and Control of Hazardous Fire Areas

Goals and Objectives

Following the significant impacts of the Cedar fire at William Heise Regional Park, planned and deliberate treatments to the remaining vegetation are required to minimize the accumulation of wildland fuels. Due to the weather conditions, topography, and vegetative communities that are in and surround the park, fire prevention efforts will surely continue. However, in the years that follow, appropriate vegetation management treatments used in conjunction with potential suppression efforts can result in a vegetative arrangement that minimizes wildfires overall impact to the park and its visitors. Management efforts to create a park setting with limited fuel hazards and effective noxious weed control should begin as soon as possible and continue in perpetuity. The fuel reduction imposed by the Cedar fire should be viewed as an opportunity to optimize the parks overall condition. The need to evaluate and maintain vegetation at acceptable levels will need to remain a top priority in the parks management.

The thirty year vegetation management plan developed for the park will appeal to the parks overall goal to provide a quality recreation environment in a beautiful wildland setting, but will acknowledge and take action to mitigate the potentially negative impacts of fuel accumulation. This plan will follow the recommendations outlined in both of the previously referenced documents, The Mitigation Strategies for Reducing Wildland Fire Risks and the county's Draft Preliminary Fire Protection Plan for William Heise Regional Park.

The proposed 30-year vegetation management plan will utilize Integrated Vegetation Management (IVM) techniques that will help park managers gain and maintain control of vegetative factors which influence wildfire behavior. In doing so, the park will also encourage a safer, healthier forest, as well as, maintain compliance with Federal environmental law (NEPA), State environmental law (CEQA), and adopted local codes.

IVM Techniques Applicable To Heise Park

The park IVM will incorporate known and accepted vegetation management practices. These treatments include unmechanized hand labor and mechanized hand labor, heavy equipment, selective herbicide application, grazing and prescribed fire. These are all tools that may be incorporated in an integrated vegetation management program[11]. Due to the variation of topography and fuel types, combinations of these practices will constitute IVM treatments within the park. Timing of the proposed actions will have significant impact on the effectiveness of each IVM treatment.

[11]Danielsen, C.W.,McClure, R., Leong, E., Kelly, M. and Rice, C. Vegetation Management Almanac for the East Bay Hills. Hills Emergency Forum. 142pp.

Unmechanized and Mechanized Tools

Hand Labor can be an effective and target specific treatment to vegetation. However, manual treatments can also be the most expensive and time consuming. Hand Labor can be utilized in the widest range of treatment areas, and needs to be considered when other treatments are not practical or are potentially damaging to the environment. Hand labor will work well in steep and difficult to access portions of the park.

Unmechanized tools include:

- Manual Pulling and Prying
- Grubbing and Hoeing (with hoe or McLeod)
- Small folding handsaws (turbo saws)
- Scythes
- Machetes
- Pole saws and loppers

Training requirements for safe, proper, and effective use of unmechanized tools is limited, but needs to be considered before implementation. Unmechanized tools have personal protective equipment (PPE) requirements, including; hardhat, safety glasses, work gloves, long sleeves, long pants, and closed toe footwear.

Mechanized tools include:

- Mowers (both walk-behind and riding)
- Tractors or heavy equipment (with mowing heads or attachments)
- Weed-whips
- Weed-whips with brush blades
- Chain saws
- Chippers

Training requirements for safe, proper, and effective use of mechanized tools is measurable and must be considered before implementation. Mechanized tools also have personal protective equipment (PPE) requirements including; hardhat, safety glasses, hearing protection, work gloves, long sleeves, long pants, and appropriate work boots. Heavy equipment will require operation by qualified personnel, certified within the State of California and briefed on best management practices for heavy equipment use within the park.

The terrain often imposes limitations to mechanized tools. While mechanical hand tools (such as chainsaws) can be used in a wide range of topography, heavy equipment, mowers, and chippers have significant limitations depending on slope. For the proposed treatments at William Heise Park, heavy equipment use will be confined or limited to slopes less than twenty-five percent (25%).

Mowing attachment ("brush hog") on a skid steer tractor

Selective Herbicide Application

The use of herbicides within treatment areas will require many considerations, but can be very effective and cost-efficient. The ability of herbicide use to be target-specific aids its overall contribution to any IVM program. In the proper setting, herbicides are often the most effective method of control; for example, killing plants that resprout repeatedly and are hard to pull from the soil[12].

There are wide ranges of available herbicides. Herbicide labels and material safety data sheets (MSDS) list susceptible target plant species and provide proper direction in the use and handling of the products. In California, herbicide prescriptions need to be made by a licensed Pest Control Advisor and applied by a state licensed applicator. The County Agricultural Commissioners office can also be utilized for additional help and understanding of herbicide use at William Heise Regional Park.

Timing the proper use of herbicides is critical to its overall success. Generally target species should be treated in early spring, before the onset of seeds. This allows for direct control of existing vegetation, as well as control of its ability to regenerate by seed germination. Selective use of herbicides at William Heise Park should target noxious weeds, select problematic native grassland species, and areas of resprouting brush species.

Application techniques for selective herbicide use include foliar spraying for control of grass species and post cut application or "hack and squirt" for resprouting brush species. Equipment required for selective application include:

- Daubers
- Backpack sprayers
- Hand-pump sprayers

[12] Danielsen, C.W.,McClure, R., Leong, E., Kelly, M. and Rice, C. Vegetation Management Almanac for the East Bay Hills. Hills Emergency Forum. 142pp.

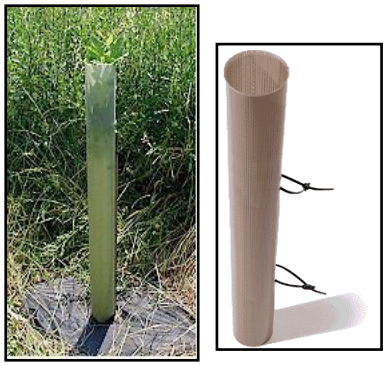
Training requirements for safe, proper and effective use of herbicides is measurable and must be considered before implementation. Herbicides have personal protective equipment (PPE) requirements outlined on the MSDS for the product, including, but not limited to, safety glasses, rubber gloves, long sleeves, long pants, and appropriate work boots.

Grazing

The use of animals to control vegetation at William Heise Park is another option. Both cattle and goats have been effective in IVM programs. However, given the additional management implications of using cattle, such as additional fencing requirements, selective and non-selective nature of eating habits, and the limitation to slopes less than thirty-five percent (35%), it is not recommended that they be utilized in Heise Park.

If used properly, goats may prove an excellent treatment method in Heise Park. Goats can be used as initial treatments following the impacts of the Cedar fire and as secondary treatments to maintain desired vegetative fuel levels following other initial treatments.

Goats utilized for reduction of vegetative cover



Sample pictures of treeshelters

Goats consume succulent regrowth of grasses and sprouting brush species, as well as flatten grass by trampling. Properly trained and managed, goats can be discriminate grazers; this is particularly helpful where large numbers of desirable plants exist. Management areas can also be pre-treated for desired species protection by utilizing well-trained dogs for herd control, portable exclusion fencing, or treeshelters. Goats can be used on slopes greater than thirty-five percent (35%), but very steep slopes should be avoided if possible.

Another consideration when using goats is the use of clean feed before they are turned out within park boundaries. Goats can spread seed of undesirable plant species if this consideration is ignored. Timing of grazing treatments will also need to be considered.

Winter grazing may have the most utility within the park. Winter grazing helps target brush and ladder fuels and will minimize impact during peak recreational use periods. Grazing in spring or summer would be effective for control of grasses and forbs. Grazing can be supplemented by additional manual and mechanical treatments to ensure effectiveness.

Prescribed Fire

Effective incorporation of prescribed fire is essential to the IVM plan. Prescribed burning can be a complicated endeavor which requires planning and notification of neighboring properties, local and state fire departments, air quality control districts, and the media. Prescribed fire has historically been recommended and utilized within the parks boundaries. Fourteen plots of varied vegetative composition were experimented with in the early 1980's, using fire as a fuel reduction and stand improvement tool. Following an IVM plan in perpetuity will allow for the safe utilization of prescribed fire as a management tool.

Several methods of prescribed fire can be used in Heise Park. These include brush piling, broadcast burning of pre-treated chaparral covered slopes, and understory burning in the forest covered portions of the park. Each will have its own management implications, pre-treatment needs and planned objectives.

Factors that effect fire behavior need to be addressed before treatment, and appropriate weather conditions need to be identified and targeted. The use of fire to maintain fuel loads is one possible application; the application of fire to mimic its natural role in the landscape is another. When fire is utilized in the park, both need to be considered.

Role of the California Vegetation Management Program (VMP)

William Heise Regional Park is managed within the State Responsibility Area (SRA). The California Department of Forestry and Fire Protection (CDF) is responsible for fire prevention and suppression efforts within the park. Under the mandate of Senate Bill 1704 (Keene), CDF created the state Vegetation Management Program (VMP). This program is designed to address wildland fuel problems throughout the state. Any prescribed burning within the William Heise Regional Park should adhere to the management practices outlined in the VMP, as this program has an approved Final Program Environmental Impact Report, as required by CEQA. San Diego county watershed managers on Palomar Mountain have already utilized successful utilization of prescribed fire following these standards.

The use of fire will not be considered an initial treatment, with the possible exception of brush pile burning. The areas most impacted by the Cedar fire should be considered pre-treated, follow-up treatment of cutting, stacking in small piles or windrows, and burning the remaining fuel should be considered. This management approach is currently utilized within San Diego County jurisdiction.

Maintaining a desired fuel condition following the devastating impacts of that fire should remain a priority. It is important to note that portions of the park adjacent to residential areas, as well as areas not impacted by the Cedar fire, will require initial IVM treatments other than fire.

Burn Piles

Burning can be used to consume piles of fuel created by the Cedar fire and produced during initial manual and mechanical treatments and following maintenance cycles. The piles would be composed of dead limbs left unburned by the Cedar fire, as well as additional fuel removed to meet targeted fuel loading levels. Piles can be controlled if burned in winter months, but minimizing the impact to soils and seedbed must be considered where appropriate.

Broadcast Burning

Broadcast burning can be effective in larger areas receiving fuel treatments, but the level of preparation can be considerable regardless of the size of the area to be burned. Broadcast burning in William Heise Park should be limited in areas difficult to manage using other IVM treatments, or to augment to results of other IVM treatments. Timing will play a large role in the safe application and effectiveness of broadcast burning for vegetation control. Broadcast burning has the potential to mimic the natural effects of wildland fires, but this effect can be in conflict with the timing that allows for effective and confident control of the prescribed fire.

Treatment Areas and Recommendations

Prioritization of vegetation management treatments is required for an effective program. Treatment areas need treatments to be prioritized and scheduled to achieve the plans goals. The following recommendations will break down the thirty-year IVM plan for William Heise Park. Treatment areas will each receive priority ranking. This priority ranking will dictate the timing of treatments.

Composition and structural components of treatment areas vary significantly within the Parks boundaries; a priority for each area will be created using criteria described below. It is important to recognize the overall reduction of fuel hazards imposed by the Cedar fire, but it is equally important to consider vegetation management to mitigate residual fuels and maintenance of vegetative communities most prone to ignition.

Treatment areas with a high priority contain the following elements:

1. Structures and Improvements
2. Roads
3. Camping Locations
4. Grassland Vegetation Open Space Areas
5. Urban Interface

Treatment areas with a moderate priority contain the following elements:

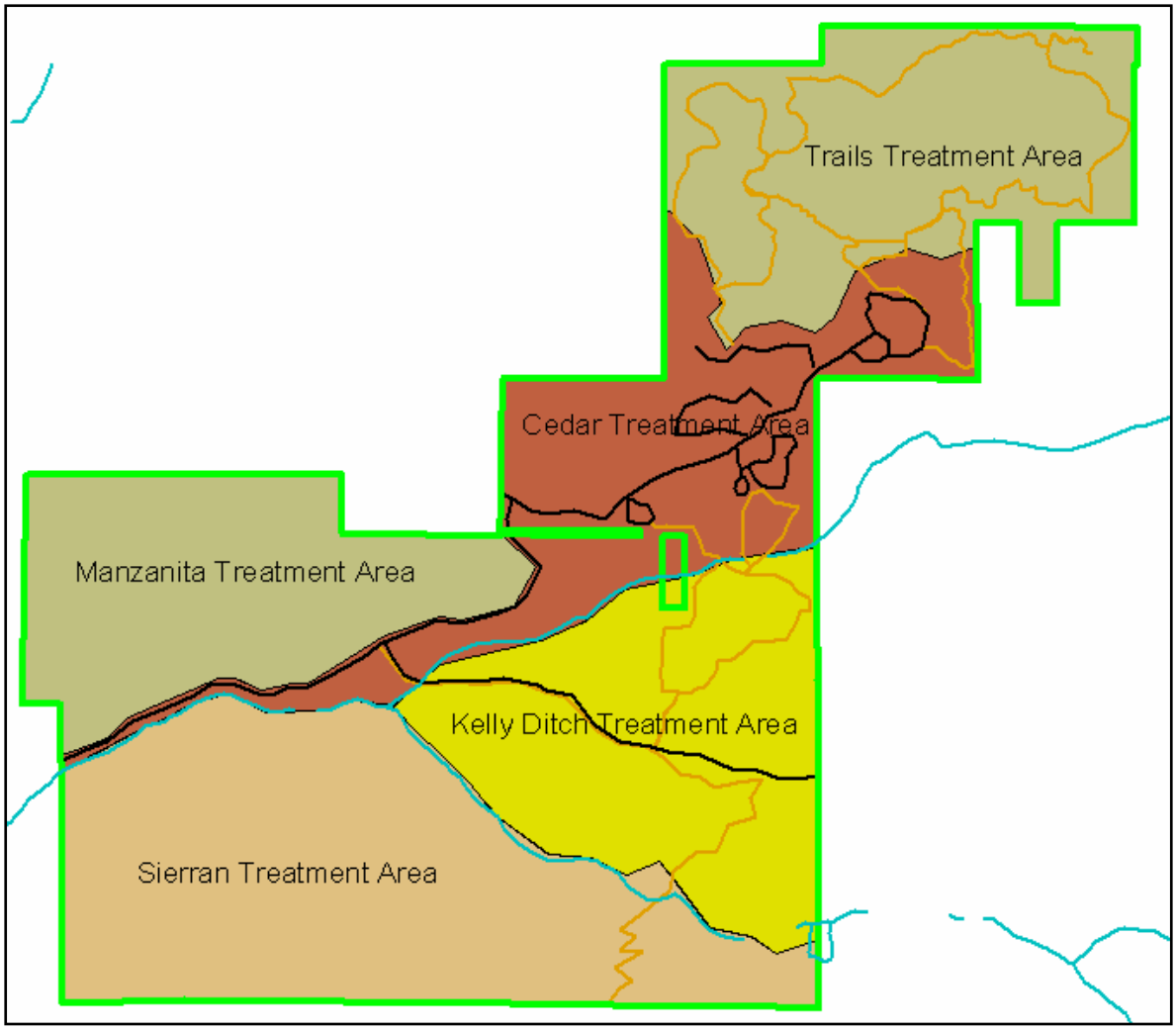
1. Sensitive Resource Areas
2. Forested Open Space Areas
3. Chaparral Open Space Areas

Using these criteria, William Heise Regional Park has been divided into the following five treatment areas:

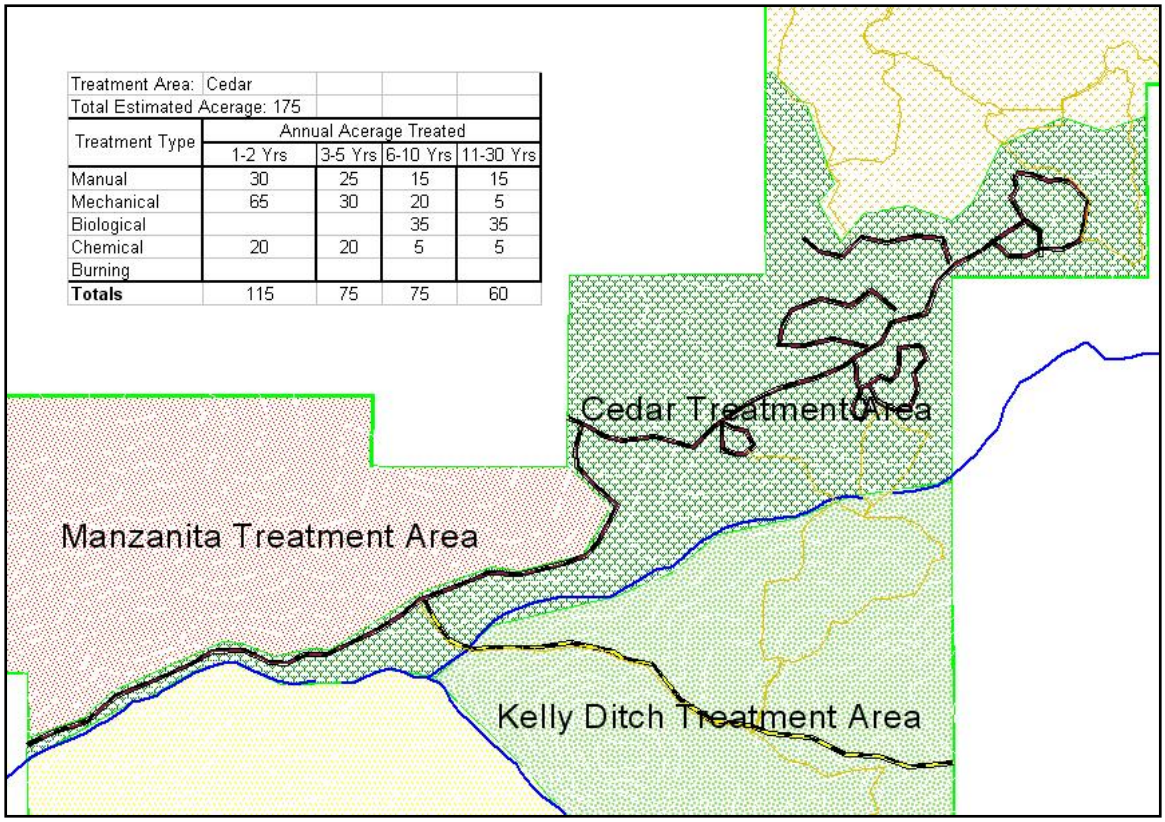
- Cedar Treatment Area
- Manzanita Treatment Area
- Sierran Treatment Area
- Kelly Ditch Treatment Area
- Trails Treatment Area

An overview map showing the treatment areas is attached and each area is discussed in detail, including management issues particular to the area.

Treatment Area Overview Map

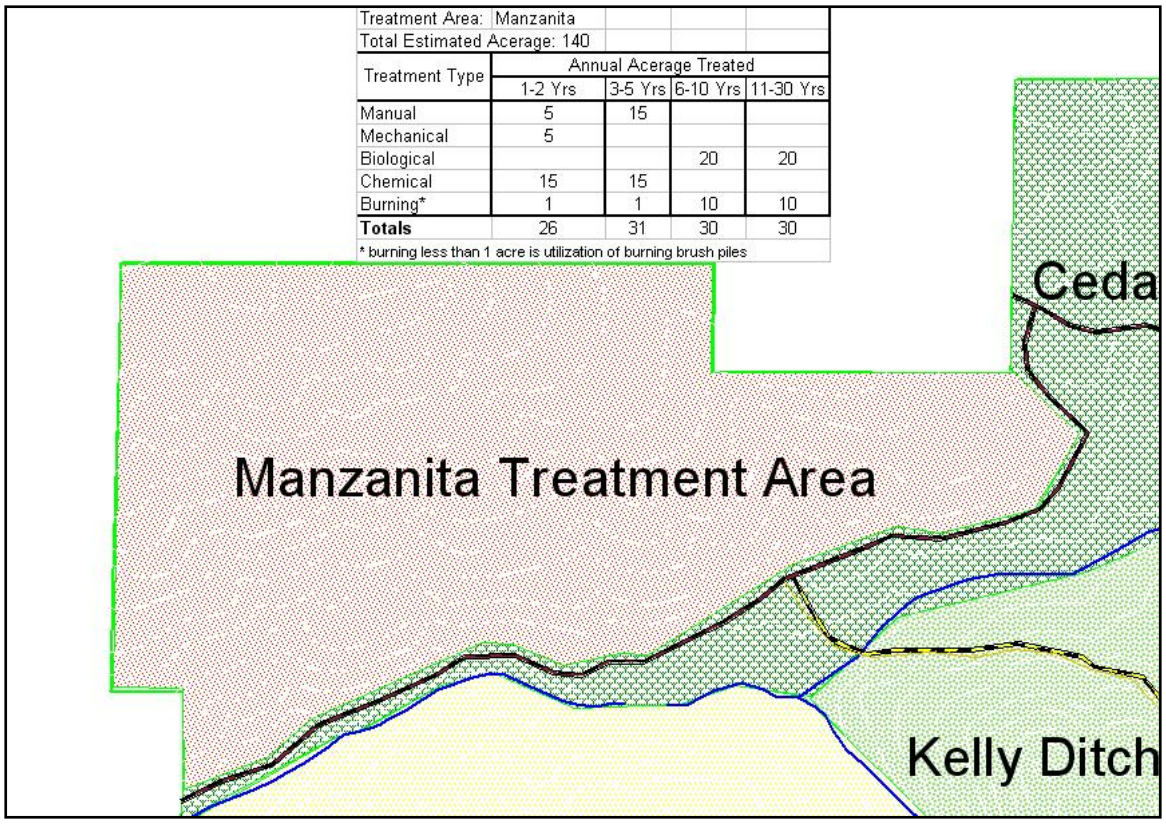


Cedar Treatment Area



This is the highest priority area in the IVM plan. It includes almost all roads, campgrounds, structures, and improvements, and represents the most intensely used central portions of the park. This treatment area is approximately 175 acres. This treatment area receives a high priority due to its intense use. The Cedar treatment area was the least impacted by the 2003 Cedar fire. This reduced impact was most likely the result of higher traffic and utilization of fuel by park visitors.

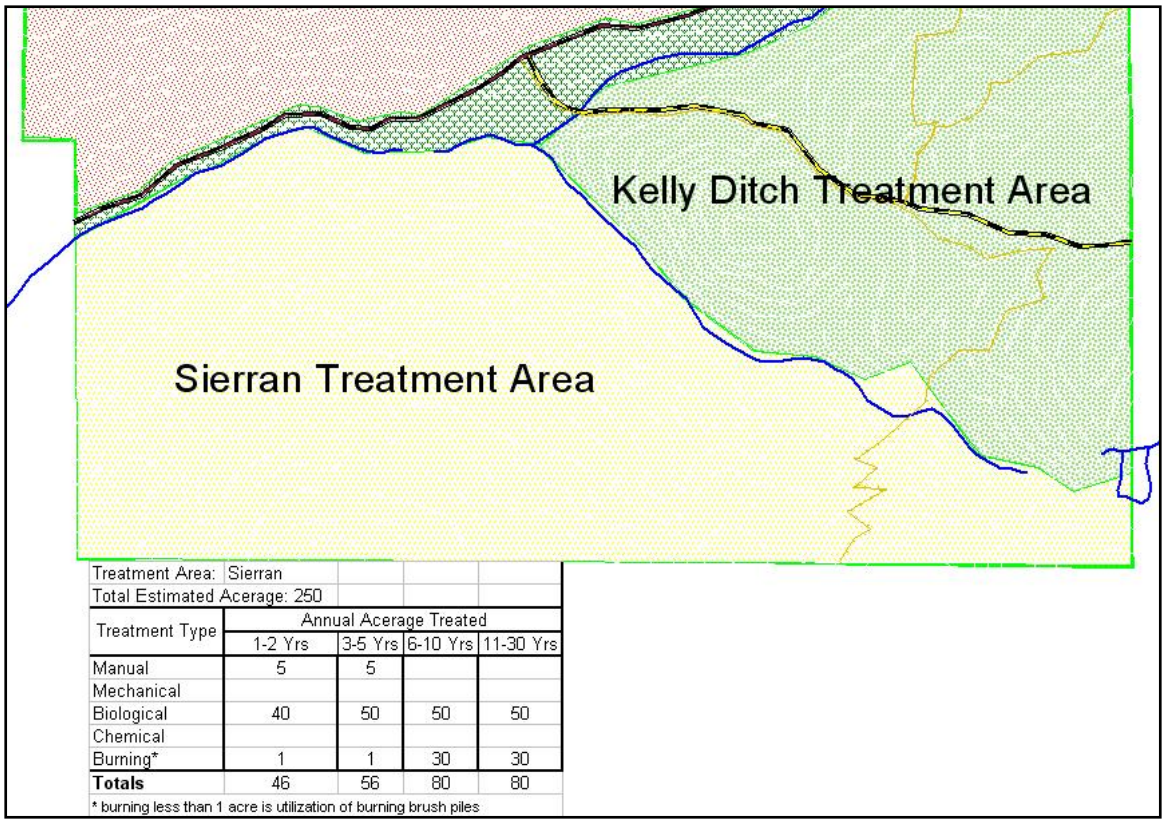
Manzanita Treatment Area



Treatment Area:	Manzanita			
Total Estimated Acerage: 140				
Treatment Type	Annual Acerage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	5	15		
Mechanical	5			
Biological			20	20
Chemical	15	15		
Burning*	1	1	10	10
Totals	26	31	30	30
* burning less than 1 acre is utilization of burning brush piles				

This management area is to the northwest of South Private Road and represents approximately 140 acres. This management unit was treated with prescribed fire in the early 1980's and should receive similar treatments in the future at the recommendation of this plan. This treatment area receives a moderate to low priority for treatments due to lack of trails and other improvements. For these reasons, the Manzanita treatment area should be considered for fuel reduction zones and eventual use of prescribed fire. The Cedar fire heavily impacted the manzanita treatment area. The goal for this treatment area is to take advantage of the currently reduced fuel condition, but also create a management cycle that better maintains regenerating vegetation for desirable stand composition and safer site conditions in the event of wildfire.

Sierran Treatment Area

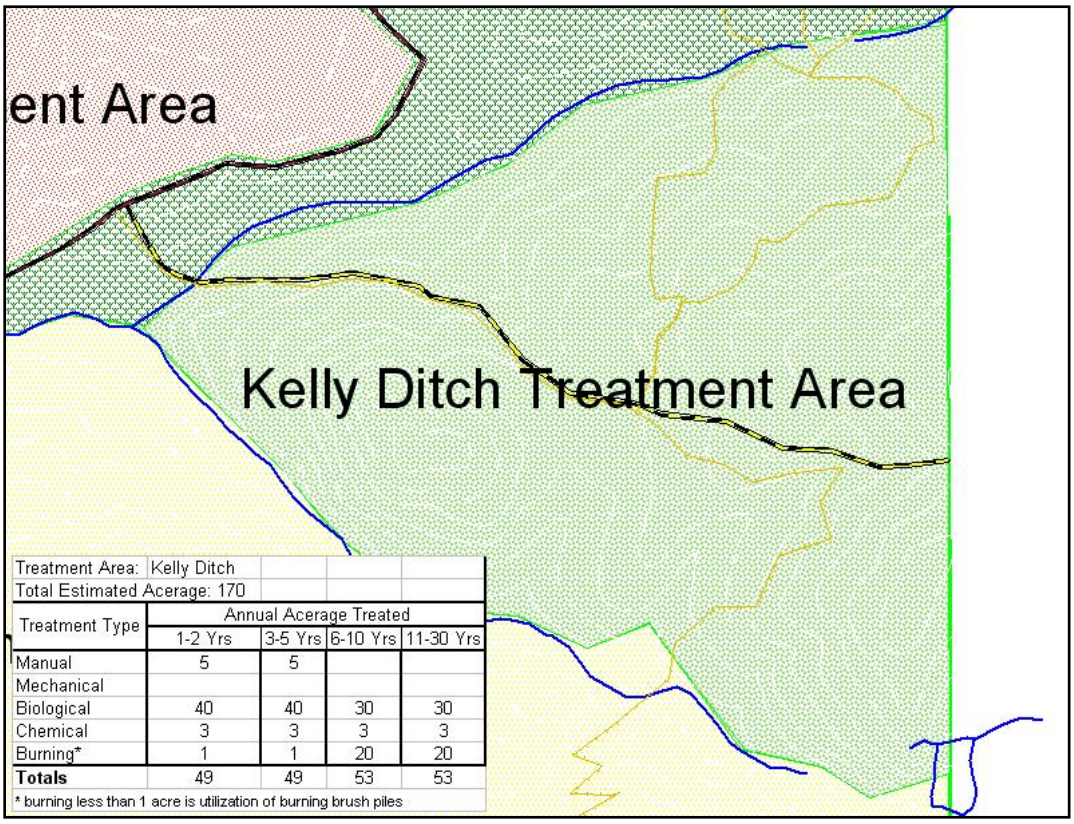


Treatment Area:	Sierran			
Total Estimated Acerage: 250				
Treatment Type	Annual Acerage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	5	5		
Mechanical				
Biological	40	50	50	50
Chemical				
Burning*	1	1	30	30
Totals	46	56	80	80

* burning less than 1 acre is utilization of burning brush piles

This management area is to the south of South Private Road and Cedar Creek. This area represents approximately 250 acres. This treatment area receives a moderate to low priority due to lack of trails and other improvements. For these reasons, the Sierran treatment area should also be considered for fuel reduction zones and eventual use of prescribed fire. The Cedar fire also heavily impacted the Sierran treatment area. As with the Manzanita treatment area, the goal is to take advantage of the currently reduced fuel condition, but create a management cycle, which better maintains regenerating vegetation for desirable stand composition and safer site conditions in the event of wildfire.

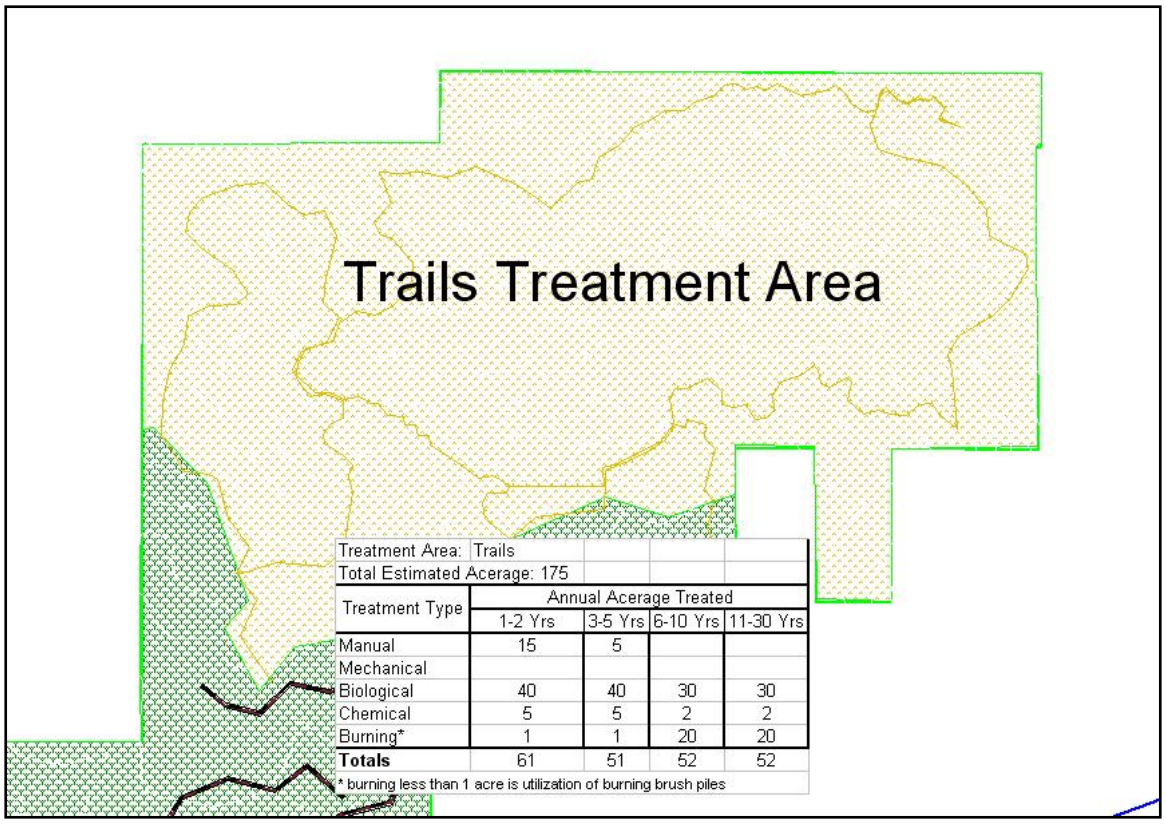
Kelly Ditch Treatment Area



Treatment Area:	Kelly Ditch			
Total Estimated Acerage: 170				
Treatment Type	Annual Acerage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	5	5		
Mechanical				
Biological	40	40	30	30
Chemical	3	3	3	3
Burning*	1	1	20	20
Totals	49	49	53	53
* burning less than 1 acre is utilization of burning brush piles				

This management area is bordered between two drainages to the north and south of Kelly Ditch Road. This area represents approximately 170 acres. This management unit was also treated with prescribed fire in the early 1980's and should receive similar treatments in the future at the recommendation of this plan. This treatment area receives a moderate priority due to involvement in the parks road and trail network. For these reasons, the Kelly Ditch treatment area should also be considered for road and trail fuel reduction zones and eventual use of prescribed fire. The Cedar fire also heavily impacted the Kelly Ditch treatment area. As with the Manzanita and Sierra treatment areas, the goal is to take advantage of the currently reduced fuel condition, but also create a management cycle that better maintains regenerating vegetation for desirable stand composition and safer site conditions in the event of wildfire.

Trails Treatment Area



Treatment Area:	Trails			
Total Estimated Acerage: 175				
Treatment Type	Annual Acerage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	15	5		
Mechanical				
Biological	40	40	30	30
Chemical	5	5	2	2
Burning*	1	1	20	20
Totals	61	51	52	52

* burning less than 1 acre is utilization of burning brush piles

This management area is in the Northeast portion of the park. This area represents approximately 175 acres. This treatment area receives a high to moderate priority due to its dominant involvement in the parks trail network. For this reason, the Trails treatment area should also be considered for variable width trail fuel reduction zones, and eventual use of prescribed fire. The Cedar fire heavily impacted the Trails treatment area. This unit also has a dominant presence of fast-growing chaparral species. Annual monitoring of regeneration should be considered in high use portions of this treatment area. Steep slopes and lose soils will make mitigation of overgrown vegetation difficult and costly if these conditions are permitted to develop.

Suggested Timetable For Management Treatments

Treatment Prescriptions for First Two Years

Initial management actions will be achieved in high priority treatment areas within the park. Focus on public safety elements and increased adherence to state and local fire codes within the high use park areas. Treatments will promote the development or maintenance of defensible space and fuel breaks in improved and high use portions of the park. For these reasons, the 175 acres in the Cedar treatment area are prescribed the most work in the first two years of the IVM plan.

Tasks

1) Establishment and maintenance of defensible space around all park improvements and structures within the Cedar treatment area as outlined in the Parks Fire Protection Plan (FPP).
    a. Park headquarters
    b. Restrooms
    c. Maintenance buildings
    d. Cabins and campsites
    e. Create road and trail vegetation buffers
    f. Water tanks and fire hydrants vegetation buffers
2) Annual inspection of high traffic forested areas for hazardous trees and limbs created by forest pathogens, fire, and other disturbances. Dead, diseased, or dying trees that target trails, parking areas, or improvements in the park need to be mitigated promptly.
3) Maintenance of completed treatments in select vegetation types in all treatment areas ranked with high or moderate priorities:
    a. Grassland defensible areas
    b. Brush in defensible space areas
    c. Forested open space area ladder fuel reduction
4) Understory reduction of ladder fuels in high use areas of the Cedar treatment area or where practical and effective.
5) Identification of potential fuel reduction zones in Manzanita, Sierran, Kelly Ditch and Trails treatment areas:
    a. Road and trail buffers
    b. Open space buffers
6) Select use of brush pile burning in winter all treatment areas
7) Identification of potential prescribed fire locations within the Manzanita, Sierran, Kelly Ditch and Trails treatment areas:

a. Grassland open space treatment areas

b. Brush open space treatment areas

c. Forested open space treatment areas

Treatment Prescriptions for Three to Five Years

Management actions will maintain high priority treatment areas within the Cedar treatment area of the park, as well as target additional treatment areas. Provide continued focus on public safety elements and maintained adherence to state and local fire codes within the high use park areas. Treatments will provide maintenance of defensible space and fuel breaks in improved and high use portions of the park.

Tasks

1) Maintenance of defensible space around all park improvements and structures:

    a. Park headquarters

    b. Restrooms

    c. Maintenance buildings

    d. Cabins and campsites

    e. Roads with vegetation buffers

    f. Water tanks and fire hydrants

2) Annual inspection of forested area for hazardous trees and limbs created by forest pathogens, fire, and other disturbances.

3) Establishment of defined fuel reduction zones in select vegetation types within the Manzanita, Sierran, Kelly Ditch and Trails treatment areas:

    a. Additional grassland open space areas

    b. Additional brush open space areas

    c. Additional forested open space area ladder fuel reduction

4) Maintenance of reduced ladder fuels in high use areas in Cedar treatment area and other locations as practical.

5) Continued use of select brush pile burning in winter in all treatment areas.

6) Refined identification of prescribed fire treatment areas within Manzanita, Sierran, Kelly Ditch and Trails treatment areas:

    a. Development of concise treatment areas and preparation

    b. Submitting to CDF for review and evaluation

    c. Public scoping

Treatment Prescriptions for Six to Ten Years

Management actions will continue to maintain high priority treatment areas within the park, as well as target additional treatment areas. Provide continued maintenance of public safety elements and adherence to state and local fire codes within all park areas. Treatments will provide maintenance of defensible space and fuel breaks and fuel reduction zones

Tasks

1) Maintenance of defensible space around all park improvements and structures:
    a. Park headquarters
    b. Restrooms
    c. Maintenance buildings
    d. Cabins and campsites
    e. Roads with vegetation buffers
    f. Water tanks and fire hydrants
2) Two-year inspection of forested area for hazardous trees and limbs created by forest pathogens, fire, and other disturbances.
3) Maintenance and further development of defined fuel reduction zones in Manzanita, Sierran, Kelly Ditch and Trails treatment areas:
    a. Grassland open space areas
    b. Additional brush open space areas
    c. Additional forested open space area ladder fuel reduction
4) Two- to three-year maintenance cycle of reduced ladder fuels in all treatment areas or where necessary and practical.
5) Continued use of brush pile burning in winter in all treatment areas
6) Implementation of broadcast prescribed fire procedures:
    a. Use of fuel breaks and fuel reduction zones for fire control and suppression
    b. Follow-up treatments to improve and augment fuel reduction zones

Treatment Prescriptions Eleven to Thirty Years

Management actions will maintain or improve all treatment areas within the park. Provide continued maintenance of public safety elements and adherence to state and local fire codes within all park areas. Treatments will provide maintenance of defensible space and fuel breaks and fuel reduction zones.

Tasks

1) Maintenance of defensible space around all park improvements and structures:
    a. Park headquarters
    b. Restrooms
    c. Maintenance buildings
    d. Cabins and campsites
    e. Roads with vegetation buffers
    f. Water tanks and fire hydrants
2) Two- to three-year inspection of forested area for hazardous trees and limbs created by forest pathogens, fire, and other disturbances.
3) Maintenance of defined fuel reduction zones:
    a. Grassland open space areas
    b. Additional brush open space areas
    c. Additional forested open space area ladder fuel reduction
4) Two- to three-year maintenance cycle of reduced ladder fuels in high use areas or where necessary and practical.
5) Continued use of brush pile burning in winter in all treatment areas.
6) Continued use of broadcast prescribed fire procedures in two- to five-year cycles:
    a. Use of fuel breaks and fuel reduction zones for fire control and suppression
    b. Follow-up treatments to improve and augment fuel reduction zones

Summary Tables

Treatment Area: Cedar Total Estimated Acreage: 175				
Treatment Type	Annual Acreage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	30	25	15	15
Mechanical	65	30	20	5
Biological			35	35
Chemical	20	20	5	5
Burning				
Totals	115	75	75	60

Treatment Area: Manzanita Total Estimated Acreage: 140				
Treatment Type	Annual Acreage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	5	15		
Mechanical	5			
Biological			20	20
Chemical	15	15		
Burning*	1	1	10	10
Totals	26	31	30	30

** burning less than 1 acre is utilization of burning brush piles*

Treatment Area: Sierran Total Estimated Acreage: 250				
Treatment Type	Annual Acreage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	5	5		
Mechanical				
Biological	40	50	50	50
Chemical				
Burning*	1	1	30	30
Totals	46	56	80	80

** burning less than 1 acre is utilization of burning brush piles*

Treatment Area: Kelly Ditch Total Estimated Acreage: 170				
Treatment Type	Annual Acreage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	5	5		
Mechanical				
Biological	40	40	30	30
Chemical	3	3	3	3
Burning*	1	1	20	20
Totals	49	49	53	53

** burning less than 1 acre is utilization of burning brush piles*

Treatment Area: Trails Total Estimated Acreage: 175				
Treatment Type	Annual Acreage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	15	5		
Mechanical				
Biological	40	40	30	30
Chemical	5	5	2	2
Burning*	1	1	20	20
Totals	61	51	52	52

** burning less than 1 acre is utilization of burning brush piles*

Treatment Area: All Total Estimated Acreage: 175 910				
Treatment Type	Annual Acreage Treated			
	1-2 Yrs	3-5 Yrs	6-10 Yrs	11-30 Yrs
Manual	60	55	15	15
Mechanical	70	30	20	5
Biological	120	130	165	165
Chemical	43	43	10	10
Burning	4	4	80	80
Totals	297	262	290	275

Management and Planning Team

Successful implementation of treatment will require the development of a management team. This team should be comprised to provide input from significant stakeholders in Heise Park's management. This can include members of the current county Parks and Recreation staff, as well as members from County Fire Management, County Weights and Measures, Watershed managers, the California Department of Forestry, private consultation firms, and others upon need.

This team would be responsible for the planning and scheduling and evaluation of treatments on an annual basis. Funding for this team should be considered when grants or implementation money is solicited. The management team should have access to all the gathered Geographic Information Systems (GIS) data sets, and an appropriately trained individual to meet mapping and continued analysis needs.

Analysis

In order to make management recommendations for Heise Park vegetation that effectively address current conditions, a combination of remote sensing data and field data was utilized. Remote sensing data was field checked for accuracy using sample plots.

Geographic Information Systems

Using a Geographic Information System (GIS) allows managers to build layers of data for a chosen area. Individuals trained in the utilization of GIS data will add great value to the continued use of this plan. Using the current data in conjunction with additional future remote sensing data will allow San Diego County to monitor the progress of vegetation management treatments.

Sources

To fully understand the environment at Heise Park, Davey Resource Group compiled data from various sources to create multiple analysis projects. The sources are listed below, including data layers used.

San Diego Association of Governments (SANDAG)

SANDAG is an association of local governments comprised of 18 cities and San Diego County. The organization has been using and developing GIS for the region since the 1970's. Information available from SANDAG includes data on land use, demography, environment, and public facilities. GIS layers utilized in the Heise Park analysis include:

- Vegetation (1995 revision)
- Soils Series
- National Wetlands Inventory
- Elevation Contours (40 foot, Regional)

SANDAG website:
http://www.sandag.org/index.asp?subclassid=100&fuseaction=home.subclasshome

San Diego Geographic Information Source (SanGIS)

SanGIS is a joint powers agency created by the City and County of San Diego. Previously the Regional Urban Information System (RUIS), this partnership was developed to ensure high quality GIS data is maintained. SanGIS houses, updates, and distributes the regional geographic data. Similar to SANDAG, various data layers on environment and governmental jurisdictions are available. Purchased for the Heise Park analysis are:

- County Parks (Parks_cn layer)
- Aerial Imagery Cedar fire (Post Firestorm 2003)

Interactive map viewing is available at http://www.sangis.org/. Separate data layers are also available for purchase.

Native Communities Development Corporation (NCDC)

NCDC uses high resolution satellite imagery and advanced analytical and verification techniques to prepare highly detailed and accurate maps showing man-made features such as roads, fence lines, power lines, oil & gas wells, buildings, and other structures. Using "multi-spectral" remote sensing imagery, NCDC is also able to identify and assess natural resources including wetlands, agricultural lands, timber stands and hazardous fuels accumulations, roof composition, dangerous wilderness, and wild urban interfaces (WUI). Using satellite imagery provided by Digital Globe, NCDC provide analysis for:

- Fuels categorization
- Burned, dead, dying, and diseased vegetation identification
- Satellite imagery includes near-infrared display

NCDC's categorization of vegetation-based fuel types is one component of the semi-automated mapping of wildfire mitigation inputs. NCDC's mapping of fuels categories is not intended to represent a particular set of "fuels models," nor is it intended to represent the precise spatial mapping of vegetation "species or types". The purpose and intent are to simply assign visible vegetation patterns into basic "best-fit" categories that may be of further use to fire personnel in defining fuels models. A full explanation of NCDC's fuels analysis is provided in Appendix A, "NCDC Data Summary Report".

Davey Resource Group (DRG)

Certain information was not available in GIS-compatible format. To better delineate park boundaries and vegetation zones, DRG used field observations and written materials (i.e., "Draft Preliminary Fire Management Plan") to plot new shape files for:

- Trails, roads, and major structures
- Water tanks and hydrants
- Recommended vegetation treatment areas

Field Data

Two methods of field data were collected to supplement the remote sensing and satellite imagery. Tree sample data was collected as point data to verify the satellite image analysis by NCDC. Plot data is designed to provide a snapshot of field conditions within each of the vegetation classes.

Tree Sample Data

Based on a model developed by NCDC, specific data was collected for individual trees identifiable on the satellite imagery. The intent is to verify how accurate the computer analysis of fuels categories and burned, dead, dying, and diseased (BDDD) classification is. While the fuels categorization is determined to be mostly accurate, the BDDD needs more refinement of the computer algorithms to effectively identify according to the needs of San Diego County.

Plot Data

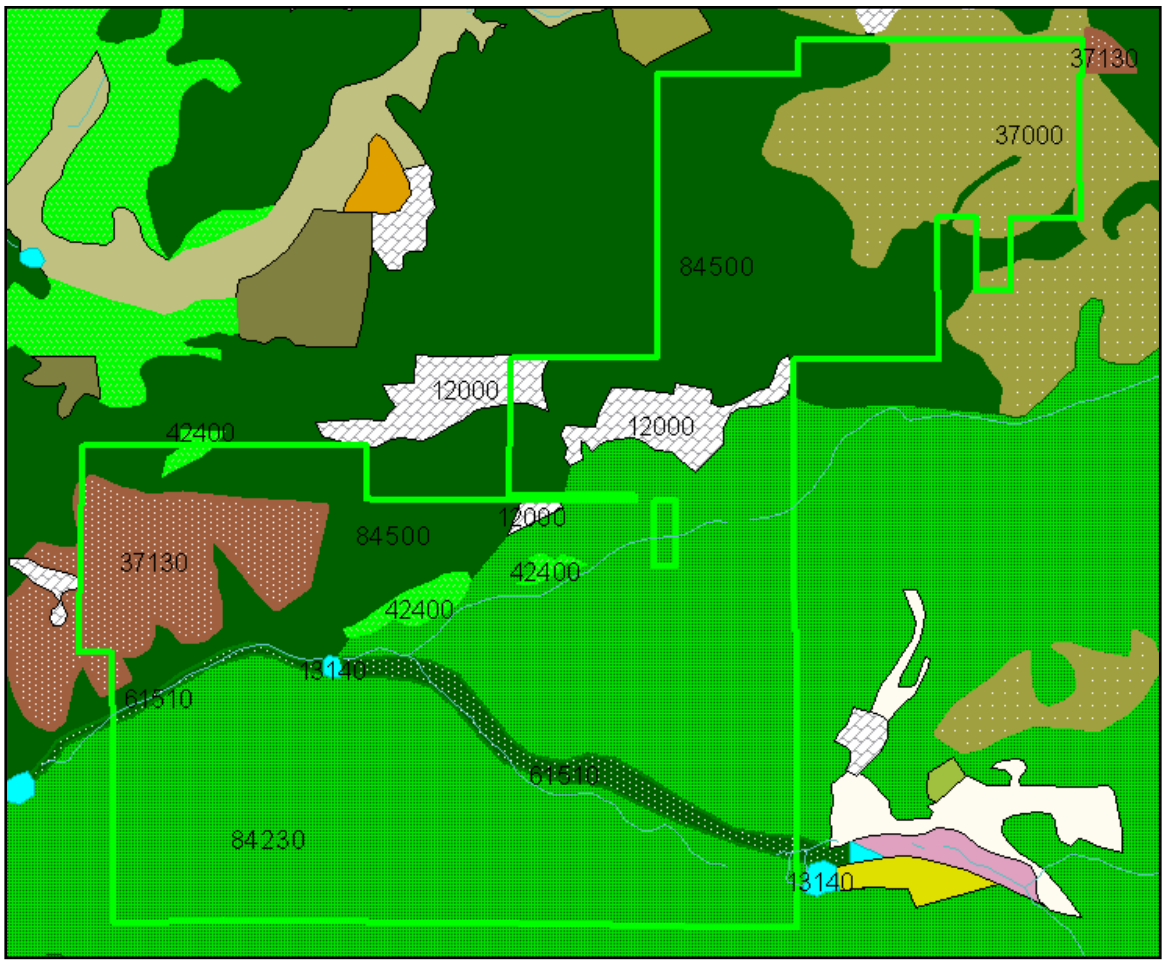
To provide a statistical reference for Heise Park's vegetation, DRG created a data collection routine and sent two ISA certified arborists to the Park. Data plot centers were initially drawn over a map of the Park's vegetation classes without referencing satellite imagery or topography layers, to prevent bias. Each plot measured a 35-foot radius, providing approximately 1/10-acre samples (43,560 sq ft per acre). As appropriate, photos were taken of either the plot center or the surrounding vegetation. The Global Positioning Satellite (GPS) coordinates were recorded using a Garmin eTrex handheld unit in order to provide future visits to the same plots for time-comparison. Elevation was also recorded, and slope and aspect estimated by compass reading. Within the plot, DRG tallied all tree species, manzanita, and chaparral (including chamise) by diameter and height class. Additionally, all young regeneration (less than 1-inch diameter) of these species was estimated. Ocular estimates of mortality, fuel shading (open sky above the plot), and ground cover (bare earth covered by some type of vegetation) were also recorded. Summary of number of points per vegetation class is categorized below:

Plots By Original Holland Vegetation Class

Holland Category	Plot #
Urban/Developed (12000)	1, 20*, 25*
Chaparral (37000)	18, 21, 22
Mixed Chaparral (37130)	7, 8, 9
Grassland (42400)	26
White Alder Riparian Forest (61510)	3
Mixed Oak/Conifer Forest (84500)	6, 10, 11, 14, 15, 16, 17, 19, 23, 24
Sierran Mixed Coniferous Forest (84230)	2,3, 4, 5, 12, 13

**According to vegetation map, these plots fall in Mixed Oak/Conifer Forest, though the area has been developed (Tent Area).*

Map of Holland Vegetation Classes

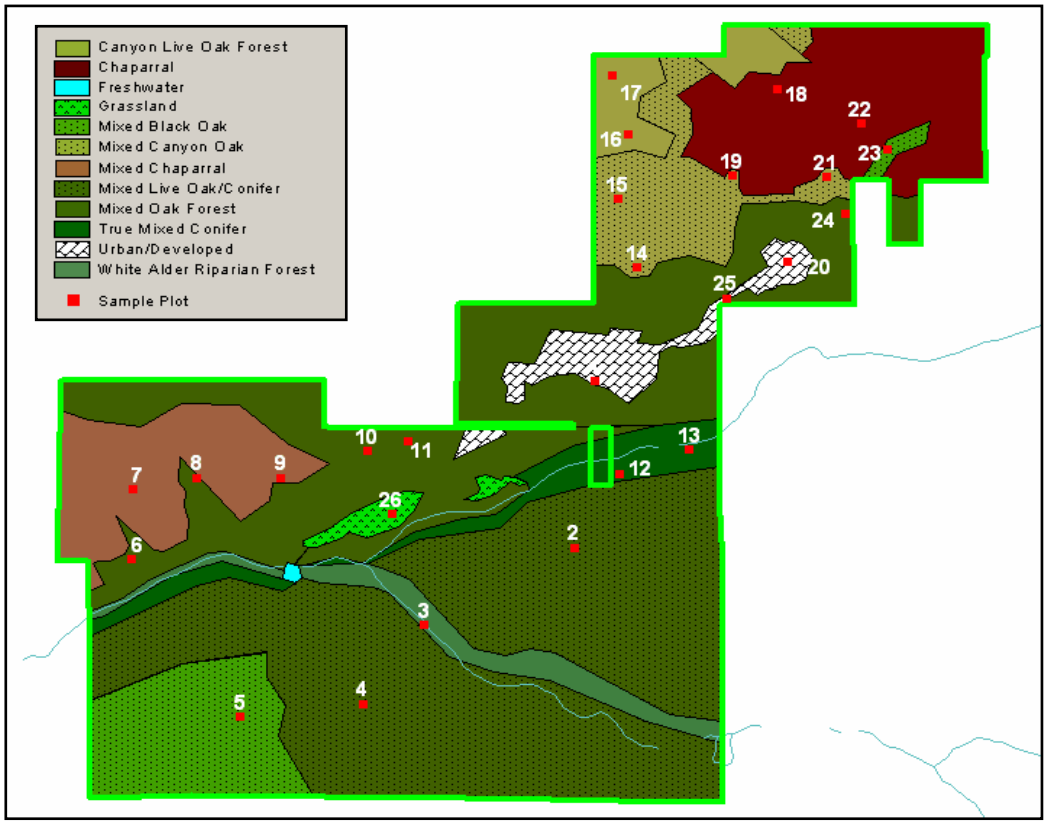


Due to differences in field conditions and the established Holland vegetation class data, the classes may be broken into sub-zones according to vegetation represented and composition. As a result, some plots are reclassified. This was done to provide a more accurate reflection of vegetation, grouping by areas with like management issues.

Plots By Adjusted Class or Sub-Zones

Holland Class or Sub-Zone	Plot #
Urban/Developed	1, 20, 25
Sierra Mixed Coniferous Forest	12, 13
Mixed Black Oak	5, 23
Coast Live Oak/Conifer	2, 4
White Alder Riparian Forest	3
Canyon Live Oak Forest	16, 17
Mixed Canyon Live Oak	14, 15, 19, 21
Chaparral	18, 22
Mixed Chaparral	7, 8, 9
Mixed Oak Forest	6, 10, 11, 24
Grassland	26

Map of Vegetation Sub-Zones



Native Communities Development Corporation
Satellite Imaging & Mapping Division

Davey Resource Group:
San Diego BDDD Mapping Project

Data Summary Report

Prepared By:

Native Communities Development Corporation
Satellite Imaging & Mapping Division
Colorado Springs, Colorado
William J. Whatley, Principal Investigator

Submitted To:

Scot Sanders
Urban and Community Forestry Specialist
Davey Resource Group

December 31, 2004

- Contents -

1.0 INTRODUCTION

In early November, 2004, the Davey Resource Group (DRG) submitted an inquiry to the Native Communities Development Corporation (NCDC) for a cost estimate pertaining to the potential acquisition of high resolution satellite imagery for three small "parks" located just east of San Diego, California. Initial examination of the DigitalGlobe archives by the NCDC confirmed that recent satellite imagery did exist which covered the proposed project areas. A request was then submitted by the NCDC to DigitalGlobe seeking confirmation that the archived imagery matched the mapping parameters required by the NCDC. A cost estimate was also requested by the NCDC. Unfortunately, fulfillment of these requests was delayed due to a corporate restructuring within DigitalGlobe.

By early December, 2004, the NCDC acquired the requested information from DigitalGlobe and immediately submitted a cost quote for the imagery to the DRG. It was recommended by the NCDC that a 1000-foot buffer be placed around the entire perimeter of each of the three identified parks, and, that this buffered area be included in the imagery order. Mr. Scot Sanders of the DRG concurred with this recommendation and subsequently issued a purchase order to the NCDC for the satellite imagery.

Also in early December, 2004, the DRG submitted an inquiry to the NCDC regarding the potential provision of mapping services. The "need" identified by the DRG was for 1) the delineation and mapping of basic vegetative fuels categories, and; 2) the delineation of probable burned, dead, dying and/or diseased timber. Following a series of explanatory discussions between Mr. Wm. Whatley of the NCDC and Scot Sanders, a purchase order was issued to the NCDC for the provision of the mapping services.

In mid December, 2004, the NCDC completed the orthorectification of the QuickBird satellite imagery and delivered the image data-set to Scot Sanders via Federal Express overnight delivery. This rapid delivery was performed in order to enable the DRG to begin using the satellite imagery in their contracted mapping tasks. By late December, 2004, the NCDC completed the two mapping services that had been contracted by the DRG and subsequently delivered the mapping data-set to Scot Sanders via Federal Express overnight delivery.

The following summary report provides an explanation of the mapping data-sets produced by the NCDC that were delivered to the DRG on December 29 of 2004.

2.0 PROJECT TIME-LINE

11/03/2004: DRG Submits Imagery Inquiry to NCDC
11/08/2004: DRG Submits Project Area AOIs to NCDC
11/14/2004: NCDC Submits Request for Feasibility Study/Cost Estimate to DigitalGlobe
12/01/2004: NCDC Submits Second Request for Feasibility Study/Cost Estimate to DigitalGlobe
12/02/2004: NCDC Submission of Cost Quote Options for Satellite Imagery
12/02/2004: DRG Acceptance of Imagery Order
12/07/2004: DigitalGlobe Confirmation of Image Order
12/09/2004: NCDC Submission of Cost Quote for Mapping Services
12/10/2004: DRG Acceptance of NCDC Mapping Cost Quote
12/16/2004: NCDC Delivery of Satellite Imagery
12/29/2004: NCDC Delivery of Mapping Data

3.0 SATELLITE IMAGERY

The principal data used by NCDC for this mapping project is the high resolution QuickBird satellite imagery produced by DigitalGlobe, Inc. of Longmont, Colorado. The QuickBird satellite is the highest resolution commercial satellite presently operating around the world today. DigitalGlobe and NCDC are continuing the development of value-added solutions which address clients' specific needs using the QuickBird high resolution satellite imagery.

The high resolution QuickBird satellite imagery used on this project consists of orthorectified, georeferenced, 0.61-meter resolution, color pan-sharpened digital imagery with four embedded 2.44-meter resolution multispectral sensor bands (blue, green, red and near-infrared).

The Zones of Analysis used in this study are comprised of "clipped" segments derived from the original image scenes acquired by the QuickBird satellite on September 15, 2004 at an approximate altitude of 280 miles.

4.0 SELECTED COORDINATE SYSTEM

The coordinate system used by NCDC in the performance of the contract services is as follows:

Spatial Reference:	NAD_1983_StatePlane_California_VI_FIPS_0406
Linear Unit:	Foot US (0.304801)
False Easting:	6561666.666666666 / False Northing: 1640416.666666667
Central Meridian:	116.25

5.0 NCDC MAPPING TECHNOLOGY

The NCDC's remote sensing computer systems utilize advanced hierarchal machine learning and vision software technologies that automate the identification and mapping of raster and vector based data. These systems are custom designed to maximize the extraction of data from 0.6 meter resolution QuickBird satellite imagery. Because the satellite imagery covers large geographical areas, feature mapping can be accomplished at a cost that is considerably less than most conventional GPS ground surveys.

6.0 PROJECT AREA

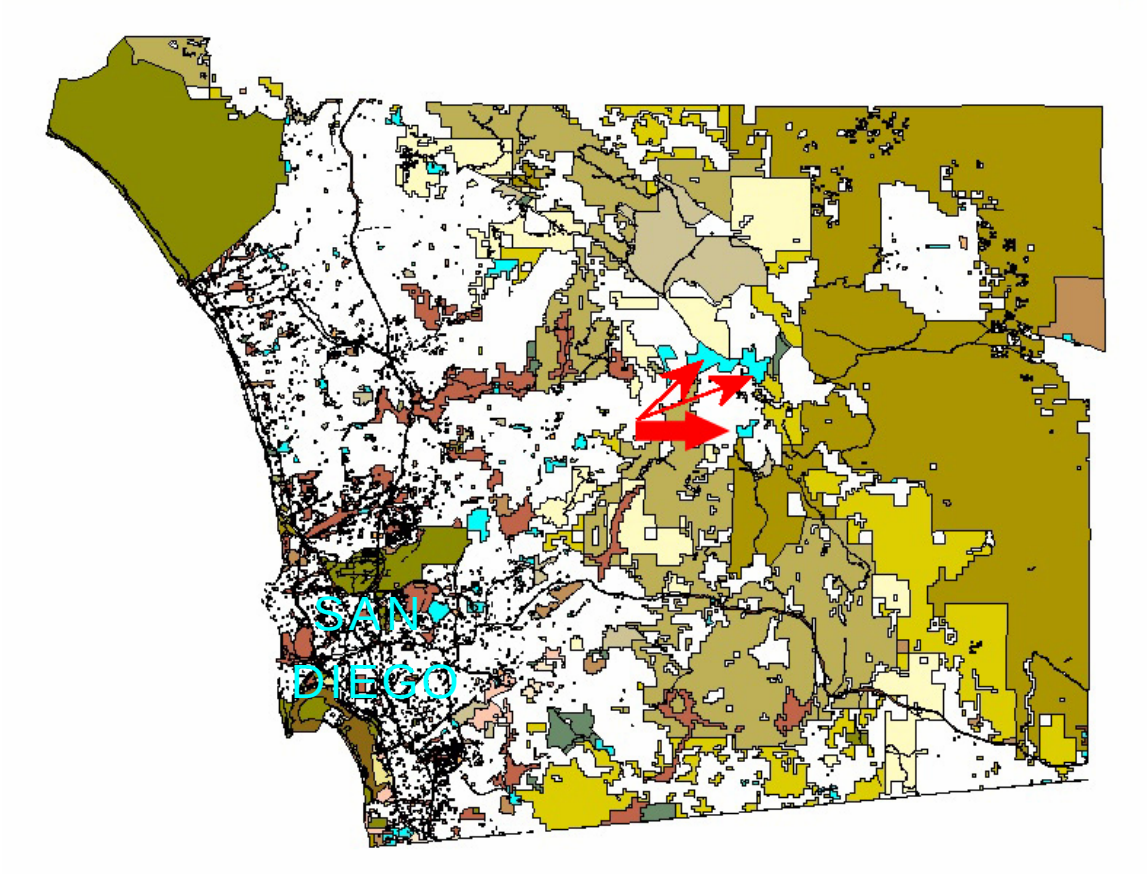
The "Zone-of-Analysis" (ZOA) refers to the total spatial area encompassed by the QuickBird satellite imagery, from which, the NCDC identified, extracted and mapped the data sets. The ZOA encompasses 15,241.23 acres which equates to 23.81 square miles or 61.67 square kilometers.

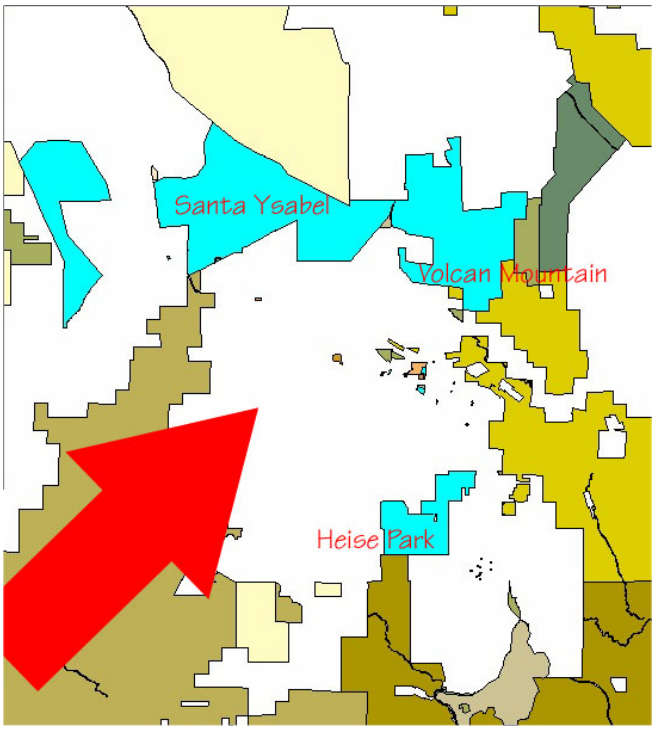
The "Contracted Project Area" (CPA) refers to the total spatial area that the NCDC was formally contracted to map. The CPA includes the boundaries of the three delineated parks plus a 1000 foot buffer zone surrounding each park. The CPA encompasses 11,427.81 acres which equates to 17.85 square miles or 46.24 square kilometers. It is located entirely within the ZOA.

The "Areas of Interest" (AOI) refer to the three delineated parks which include 1) Santa Ysabel; 2) Volcan Mountain, and; 3) Heise Park. The AOI is located entirely within the CPA and encompasses a total of 7,341 acres. It includes the following areas:

Santa Ysabel: 3,738.75 acres (5.84 square miles/15.13 square kilometers)
Volcan Mountain: 2,659.45 acres (4.15 square miles/10.76 square kilometers)
Heise Park: 943.35 acres (1.47 square miles/3.81 square kilometers)

Location of the Areas of Interest
San Diego County, California





7.0 FUELS CATEGORIZATION

NCDC's categorization of vegetation based fuel types is one component of the semi-automated mapping of wildfire mitigation inputs. NCDC's mapping of fuels categories is not intended to represent a particular set of "fuels models," nor is it intended to represent the precise spatial mapping of vegetation "species or types". The purpose and intent are to simply assign visible vegetation patterns into basic "best-fit" categories that may be of further use to fire personnel in defining fuels models. These best-fit categories generally include the six categories identified below. Each of these six categorizes are described in greater detail in this document.

NCDC Fuels Categories

Timber *(Trees)*
Scrub/Timber *(Tree-Scrub Mix)*
Scrub *(> 4ft high but not really a Tree)*
Shrub/Scrub *(Shrub-Scrub Mix)*
Shrub *(<4ft high but not grass)*
Burned

The process utilized by the NCDC initially involves subjective assignment of a vegetation pattern to a fuels category using simple fuels category definitions, and heavy emphasis on the observation of visual attribute patterns evident in the high-resolution satellite imagery. Whenever possible, the assignment is supplemented by ground verified observations (data points).

This effort produces a series of "training samples" that are used as inputs into a computer based automated extraction process that relies upon hierarchal learning. The hierarchal learning involves the systematic use of "iterations" wherein the analyst repeatedly confirms accurate and in-accurate identifications generated by each pass of the computer's automated extraction process. This system can involve from three to eight iterations (passes). Inherent in this system is the fact that bias is introduced and maintained by the analyst who is teaching the automated extraction process. It is therefore important that the analyst have a firm understanding of the vegetation being mapped. When possible, the analyst should be equipped with an adequate number of ground verified data points. However, the color pan-sharpened QuickBird high-resolution satellite imagery (source data) is capable of displaying individual trees, shrubs and plants at a pixel resolution of 0.6 meters. As a result, a shrub encompassing only four square feet of spatial area can be seen by the analyst in the imagery and subsequently mapped by the automated extraction process. This visual "strength" often permits identification of "species" directly from the satellite imagery. Therefore, even with bias and/or potential "false identifications" included, NCDC's categorization of vegetation based fuels types is far more accurate than mapping accomplished with LandSat 30 meter pixel resolution imagery because the "targets" can be seen. In addition, it is also far more cost efficient than precision mapping of the individual vegetation species.

7.1 Timber *(Trees)*

The fuels category "Timber" includes both individual freestanding trees and groves of trees characterized by an interconnected canopy. Trees are assumed to be greater than 10 feet in height but can be intermixed with shorter specimens of the same or similar species (saplings), or with a Scrub category such as oak or willow. In such cases of intermixing, the sub-category "Scrub/Timber" can be used. However, if it is apparent that the vast majority (75%+) of the specimens are actual trees, then the Timber categorization would be applied.

Individual tree crowns usually are greater than 50 square feet in spatial area (plan view) and almost always exhibit visible textural shadowing within the crown or canopy that is indicative of branching and

slight variations in foliage height. This is accompanied by variations in color that are also the result of branching and slight variations in height. However, special attention must be paid towards globe willows and other domed trees where branching is often not visible, yet height variation occurs that is uniformly distributed around the crown. Another key characteristic of the Timber fuels category is the shadow that is cast by the individual tree or the stand of trees, depending on the sun's position and the angle of the satellite imagery. This ground shadow can confirm the dominant height of the Timber category and is a valuable key in distinguishing Timber from shorter vegetation.

Extraction/mapping of the Timber Category requires multiple trained extractions of unique Timber patterns. The uniqueness of the patterns may reflect a species type, a particular crown shape, and/or a combination of texture, hue and multispectral reflectance (Including shadowing). These multiple extractions are then combined to form a single Timber fuels category.

Strengths & Weaknesses: The Timber fuels category mapping from QuickBird satellite imagery is considered very accurate when compared to vegetation mapping/assignment using LandSat 30 meter pixel resolution imagery. This accuracy is best exemplified by the fact that isolated, free-standing trees are recorded, as are "surviving trees" located within burned areas.

However, the high pixel resolution of the QuickBird imagery can produce small "false bogies" due to the crown texture shadowing included in the initial training samples. These shadows may lead to incorrect polygon delineations of similar small shadowed areas located in non-Timbered areas. Because the inclusion of the crown texture shadowing is an inherent component of the initial training samples, these small false bogies cannot be avoided or readily excluded. Reasonable efforts are made to eliminate many of these false bogies, but the end user must be aware that some will undoubtedly be retained.

Another weakness worth noting is the occasional inclusion of a small Scrub or Shrub area within the same polygon that has (for the most part) accurately delineated a stand of Timber. These falsely assigned Shrub or Scrub areas are always situated immediately adjacent to that particular Timber stand. Their inclusion is often due to the presence of timber "saplings" intermixed (and detected) with the scrub or shrub. Reasonable efforts are made to correct most of these false assignments, but the end user must be aware that some will undoubtedly be retained.

Fuels Relevance: The fuels category "Timber" is significant due to the "biomass" of flammable material it represents that, in the case of living or unseasoned timber, is accompanied by a resin or "sap" constituent that can propagate a fire. These two dangerous attributes are further compounded by three additional factors: height, reach and density. Height pertains to a trees ability to move fire up or down in a vertical fashion (vertical laddering). Reach is the vertical placement of horizontal branching and pertains to a trees ability to retrieve fire from adjacent burning trees at various stages in its height (horizontal laddering). Density pertains to a tree's ability to rapidly spread fire to numerous adjacent trees, thereby propagating a crown fire. Last but not least is the potential "BTU" generation that varies between hardwoods and softwoods. These variables can drastically affect the height of a fire's flame, the intensity of the fire's heat, and the speed of the fire's spread.

7.2 Scrub/Timber (Mix)

The fuels category "Scrub/Timber" is assigned when a visible intermixing of both Scrub and Timber is evident that does not appear to favor either category yet conveys a visible stand formation. As such, the Scrub/Timber category always includes multiple specimens within a single polygon that exhibit characteristics of both the Scrub and the Timber fuels categories. This commonly occurs in areas where the individual plants exhibit a borderline height lending themselves to assignment within either the Scrub or the Timber fuels category. In most situations, there are nearby stands of definable Timber and Scrub that can help to define how and where this fuels category is used. The end user must therefore be aware that, within any given polygon assigned to the Scrub/Timber category, individual plants will exhibit similar or identical characteristics to specimens identified in nearby stands of definable Timber and Scrub. "Context" is therefore a major consideration when assigning a polygon to the Scrub/Timber category.

Strengths & Weaknesses: Admittedly, the Scrub/Timber fuels category represents a subjective but reasonable mapping solution for categorizing areas that exhibit a much higher degree of variation than nearby stands of definable Timber and Scrub. However, it is important to note that this variation is suggestive of a transitional ecosystem that is often associated with fuels laddering.

7.3 Scrub *(> 4ft high but not really a Tree)*

The fuels category "Scrub" includes thickets of small stem diameter foliage that are assumed to be taller than 4 feet, but comparably shorter than the visible surrounding Timber. In general terms, Scrub is between 4 to 12 feet in height. The Scrub category often includes multiple specimens within a single polygon which appear as a small grove, thicket, or briar. They are usually composed of oak, willow, Tamarisk, or sapling stands of Russian olive or Aspen. Occasionally, thickets of tall sagebrush will also be classified as scrub. Regional variations in plant species composition should be expected.

Individual crowns usually are not readily visible but a texture produced by slight shadowing from height variations is. Depending on the sun's position and the angle of the satellite imagery, Scrub should cast a ground shadow due to its height. This ground shadow is a valuable key in distinguishing Scrub from Shrub.

Scrub may be intermixed with specimens of the Timber category, in which case an effort is made to assign the intermixed stand to the "Scrub/Timber" category. Likewise, Scrub may be intermixed with shorter "Shrubs" (4 feet or less in height) in a manner that makes distinct classification not possible or not cost effective (too time consuming). This commonly occurs along steep sided ditch and riverbanks, but may also represent the peripheral edge of a Scrub thicket or a grove of Timber. In such cases of intermixing, the sub-category "Shrub/Scrub" is used where possible.

Extraction/mapping of the Scrub fuels category requires multiple trained extractions of unique Scrub patterns. The uniqueness of the patterns may reflect a species type and/or a combination of texture, hue and multispectral reflectance (Including shadowing). These multiple extractions are then combined to form a single Scrub fuels category.

Strengths & Weaknesses: Scrub fuels category mapping from QuickBird satellite imagery is considered relatively accurate when compared to vegetation mapping/assignment using LandSat 30 meter pixel resolution imagery. This accuracy is best exemplified by the fact that stands of Scrub can clearly be seen in QuickBird imagery that are comparably shorter than nearby Timber, yet taller than surrounding Shrubbery and grass. These stands can be readily extracted and mapped.

However, the high pixel resolution of the QuickBird imagery can produce small "false bogies" due to the texture shadowing included in the initial training samples. These shadows may lead to incorrect polygon delineations of similar small shadowed areas located in non-Scrub areas. Because the inclusion of the texture shadowing is an inherent component of the initial training samples, these small false bogies can not be avoided or readily excluded. Reasonable efforts are made to eliminate many of these false bogies, but the end user must be aware that some will undoubtedly be retained.

Another weakness worth noting is the occasional inclusion of small areas of Shrubbery within the same polygon that has (for the most part) accurately delineated a stand of Scrub. These falsely assigned Shrub areas are usually situated in close proximity to that particular stand of Scrub. Reasonable efforts are made to correct most of these false assignments, but the end user must be aware that some will undoubtedly be retained. Likewise, the texture, hue and shadowing defined in the initial training samples may also result in the assignment of isolated Shrubs to the Scrub fuels category. This is especially true if the plant mass exhibits a borderline height lending itself to assignment within either a Shrub or a Scrub fuels category. Last but not least is the occasional misclassification as a Scrub of peripheral shadows bordering stands of Timber. Though these are false bogies are usually found and eliminated, a few may escape detection.

Fuels Relevance: The fuels category "Scrub" is significant because it occurs in groves, thickets, and briars that collectively represent significant accumulations of flammable "biomass" that also retain significant "BTU" generation potential. These two dangerous attributes are further compounded by the two additional factors: height and density. Height pertains to the grove, thicket, or briar's ability to move fire up and into adjacent stands of Timber (vertical laddering) whereas density pertains to a grove, thicket, or briar's ability to rapidly spread fire to numerous adjacent thickets and/or stands of Timber. In addition, Scrub is usually associated with hardwoods and therefore retains the ability to produce longer burning aerial sparks or firebrands. All of these variables can drastically affect the height of a fire's flame, the intensity of the fire's heat, and the speed of the fire's spread.

7.4 Shrub/Scrub (Mix)

The fuels category "Shrub/Scrub" is assigned under two sets of conditions. First, it is assigned when a visible intermixing of both Shrubbery and Scrub is evident that does not appear to favor either category yet conveys a definable formation. In many situations, there are nearby stands of definable Shrubbery and definable Scrub that can help to indicate where this condition is met. In such situations, the Shrub/Scrub assignment will include multiple specimens within a single polygon that exhibit characteristics of both the Shrub and the Scrub fuels categories. This commonly occurs in areas where the individual plants exhibit a borderline height lending themselves to assignment within either the Shrub or the Scrub fuels categories.

The second condition for use is assignment to the Shrub/Scrub fuels category when no real distinction can be made by the analyst as to whether the plant specimen(s) are either Shrubbery or Scrub. This condition may occur in areas obscured by shadowing, along steep sided canal, ditch, stream or riverbanks, or when atmospheric distortions are present in the satellite imagery (smoke, clouds or rain). In such situations, the end user must therefore be aware that, within any given polygon assigned to the Shrub/Scrub category, individual plants will exhibit similar or identical characteristics to specimens identified in nearby polygons as Shrub or Scrub. "Context" is therefore an important consideration when assigning a polygon to the Shrub/Scrub category.

Strengths & Weaknesses: Admittedly, the Shrub/Scrub fuels category represents a subjective but reasonable mapping solution for categorizing areas that exhibit either a much higher degree of variation than nearby polygons of definable Shrub and Scrub, or a lack of definable characteristics that would permit a more accurate assignment.

7.5 Shrub *(<4ft high but taller than grass/dirt)*

The fuels category "Shrub" includes individual plants or small clusters of plants that are comparably shorter in height than the visible Scrub or Timber, yet comparably taller in height than the visible grass/dirt. Although there usually is no texture shadowing visible within the plant cluster, a very slight ground shadowing may exist around the peripheral edge indicating a height greater than surrounding grass/dirt. Comparison to the shadowing associated with nearby Shrubs can be helpful in recognizing these Shrub shadow patterns. As a general rule, Shrubs are assumed to be less than four feet in height.

In certain places where large areas of grass are presumed to exist, such as large lawns or fields, Shrubs may appear as circular/semi-circular masses of a darker colored vegetation, thereby permitting identification and assignment to the Shrub category. However, when many such masses occur within a grassy area, the entire area may best be categorized by the sub-category "Shrub/grass".

Likewise, Shrubs may be intermixed with taller Scrubs in a manner that makes distinct classification not possible or not cost effective (too time consuming). This commonly occurs along steep sided ditch and river banks, but may also represent the peripheral edge of a Scrub thicket or a stand of Timber. In such cases of intermixing, the sub-category "Shrub/Scrub" is used where possible.

Strengths & Weaknesses: Shrub fuels category mapping from QuickBird satellite imagery is considered relatively accurate when compared to vegetation mapping/assignment using LandSat 30 meter pixel resolution imagery. This accuracy is best exemplified by the fact that individual Shrub plants can clearly be seen in QuickBird imagery growing along roads and ditch banks that are comparably shorter than nearby Scrub and Timber, yet taller than the surrounding grass. These isolated plants can be readily extracted and mapped.

A weakness worth noting is the occasional inclusion of small areas of Scrub or grass within the same polygon that has (for the most part) accurately delineated a mass of Shrubbery. These falsely assigned areas are usually situated in close proximity to that particular mass of Shrubbery. Reasonable efforts are made to correct most of these false assignments, but the end user must be aware that some will undoubtedly be retained. Likewise, if the plant mass exhibits a border-line height, it may lend itself to assignment within either the Shrub or the Scrub fuels category.

Fuels Relevance: The fuels category "Shrub" generally exhibits less significance as a fuel category than Scrub or Timber, yet still retains significance due to its ability to transfer fire both vertically and horizontally to adjacent groves, thickets, or briars of Scrub, or to stands of Timber. On a "micro" level, Shrub is usually considered a hardwood and therefore retains the ability to produce longer burning aerial sparks or firebrands. Shrub fires can therefore readily transfer fire to grass, or propagate an existing grass fire into a higher level of flame intensity.

7.6 Burned

The fuels category "Burned" is used to distinguish evident areas that have been recently burned by fire. This "scar" patterning may be the result of wildfire or intentional burning such as that used by farmers. In defining burned areas, the "near infra-red" band setting of the satellite imagery is used to distinguish between living-healthy vegetation and that which is dead or dying.

Strengths & Weaknesses: Burned category mapping from QuickBird satellite imagery is considered relatively accurate although conflicts can occur with asphalt pavement and asphalt roofing tiles. In some situations, "noise" can also be introduced by the shadowing from trees, ditches and rock outcroppings.

8.0 BURNED, DEAD, DYING & DISEASED

The mapping of "burned, dead, dying and/or diseased" vegetation relies heavily on the use of the "near infra-red" band setting of the satellite imagery in order to distinguish between living-healthy vegetation and that which is dead or dying. The techniques involved are virtually identical to that used in the mapping of the "burned" fuels category, but with one major difference. In mapping burned, dead, dying and/or diseased vegetation, the initial training samples developed by the analyst are expanded to also include "blackened ground" located in the immediate proximity of what is clearly dead or burned vegetation. It is important to note that the blackened appearance is not necessarily indicative of burning, but also can be indicative of dead plant matter due to other stress factors. This produces more of a geo-spatial emphasis rather than reliance solely on individual plants. The benefit is that the blackened ground provides strong supplemental evidence of areas adversely impacted by either fire or other stress producing factors. Any vegetation located in or near the resultant delineated polygons can therefore usually be assumed to be either burned, dead or dying.

10.0 DATA DIRECTORY

On December 29, 2004, the mapping results were delivered to the DRG by the NCDC via Federal Express overnight delivery. The media used was DVD. The following listing identifies the individual files delivered:

AOI.shp	The "Areas of Interest" (AOI) referring to the three delineated parks which include 1) Santa Ysabel; 2) Volcan Mountain, and; 3) Heise Park.
BDDD_Zone.shp	The mapped geo-spatial zone within which vegetation is either burned, dead, dying or diseased (BDDD).
CPA.shp	The "Contracted Project Area" (CPA) refers to the total spatial area that the NCDC was formally contracted to map. The CPA includes the boundaries of the three delineated parks plus a 1000 foot buffer zone surrounding each park.
Fuels_Cat1_Clip.shp	The mapped geo-spatial extent of the identified fuels categories clipped to the CPA. The file has been split in to two parts to better facilitate loading and computer memory management.
Fuels_Cat2_Clip.shp	See above.
Own.shp	Original AOI file provided to the NCDC by the DRG. Derived from the "SANDAG" website where the San Diego County GIS information resides: http://www.sandag.org/resources/maps_and_gis/gis_downloads/land.asp
ZOA.shp	The "Zone-of-Analysis" (ZOA) refers to the total spatial area encompassed by the QuickBird satellite imagery, from which, the NCDC identified, extracted and mapped the data-sets.

10.0 END-USER COMMERCIAL LICENSE

A digital "pdf" copy of the DigitalGlobe, Inc. Commercial End Users license has been transferred to the Davey Resource Group by the NCDC. All uses of the QuickBird satellite imagery are to be in accordance with the specifications contained in this license agreement. In addition to the specifications contained in this license agreement, the Davey Resource Group shall recognize and maintain the NCDC as a contracted end-user of the QuickBird satellite imagery and mapping data sets produced for, and associated with, this project. NCDC use shall include the right to use the QuickBird satellite imagery and the mapping data sets in advertising and marketing presentations that further promote the NCDC products and services.

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